

## Claims

1. A method for modification and isolation of a protein comprising:
  - a) providing a protein selected from the group consisting of whey and soy proteins;
  - b) providing a reagent that forms sulfite ions;
  - c) mixing the protein with the reagent under a condition to sulfonate the protein without using an oxidizing agent and to obtain a mixture containing a sulfonated protein;
  - d) precipitating the sulfonated protein at an acid pH to form a precipitated sulfonated protein and a soluble sulfonated protein; and
  - e) recovering the precipitated sulfonated protein or the soluble sulfonated protein.
2. A method according to claim 1, wherein the protein is a whey protein and the whey protein is mixed with the reagent at a temperature in a range of 40 – 65 °C.
3. A method according to claim 2, wherein the whey protein is in a form of a concentrate and has a concentration of 9 – 12% by weight.
4. A method according to claim 1, wherein the protein is a soy protein and the soy protein is mixed with the reagent at a temperature in a range of 60-80 °C.
5. A method according to claim 1, 2, or 4, wherein the reacting step (b) is carried out at a pH in a range from 5.5 to 8.
6. A method according to claim 5, wherein the reagent comprises sulfite having a concentration from 0.02 M to 0.20 M.
7. A method according to claim 1, wherein a degree of sulfonation of the protein is affected by reaction conditions and amount of reagents used.
8. A method according to claim 1, wherein the sulfonated protein is precipitated as fractions of varying composition by adjusting the pH.
9. A method according to claim 8, wherein the sulfonated protein is precipitated by lowering the pH to 1.5 - 5.5.
10. A method according to claim 1, further comprising a step of removing sulfone groups from the sulfonated proteins and the sulfite ions that did not react with the protein, the removing step comprising lowering the pH to about

1.5 - 4, whereby the sulfone groups and the sulfite ions are liberated as sulfur dioxide and free sulfhydryl groups are created in the protein.

11. A method according to claim 1 or claim 10, further comprising a step of oxidizing the sulfite ions that did not react with the protein to sulfate by blowing air into the mixture at pH 4 - 7.

12. A method according to claim 10, further comprising a step of blowing air into the mixture at pH 4.5-8.5 and at a temperature of 45 - 75°C to form disulfide groups from the free sulfhydryl groups in the protein.

13. A method of claim 1, wherein the protein is in a form of a concentrate.

14. A method of claim 2, wherein the temperature is in the range from 50°C to 60°C.

15. A method of claim 4, wherein the temperature is in the range from 65°C to 75°C.

16. A method of Claim 5, wherein the pH of the reacting step (b) is in a range from 6 to 7.

17. A method of Claim 6, wherein the concentration of sulfite is from 0.05M to 0.10 M.

18. A method of Claim 9, wherein the pH is in a range from 4.0 to 5.0.